COVER SHEET FOR STATEMENT OF WORK
NAS1-0205X /Task Order XXXX
AWIN System Design and Flight Test Support
ORIGINAL

A. Solicitation/PR/Tracking No.: RDH-1143

B. NASA Technical Monitor:

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C. Review of Proposals:

All proposals received in response to this task description shall be reviewed by the Technical Monitor and COTR using the following equally weighted criteria: Technical Approach, Past Performance, and Cost.

D. Intellectual Property and Patent Rights

Because of pre-existing intellectual property positions of the subject matter of this task, NASA reserves the right to make patent determinations of information that may be developed from the execution of this task. Because of the public sensitivity of the subject matter of this task, NASA reserves the right to prior approval of any publication of work that results from it.

E. Send Electronic Response:

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STATEMENT OF WORK

1.0 BACKGROUND

1.1 The NASA Aviation Safety Program's (AvSP) Weather Accident Prevention (WxAP) project consists of AWIN, Turbulence Prediction and Warning System (TPAWS), and Weather Information COMMunications Systems (WINCOMM) elements. An objective of WxAP/AWIN is to "Develop Needed Weather Products and Sensing Capabilities". AWIN intends to develop improvements to weather hazard information for all aviation users with emphasis on the flight deck. Information is needed to provide enhanced situational awareness for strategic flight planning and routing decisions, and for real-time in-route tactical decision making in the presence of atmospheric hazards including all classes of turbulence, wind shear, icing conditions, low visibility and ceilings, wake vortices, convection and winds, and volcanic ash.

1.2 The Airborne Hazard Awareness System (AHAS) comprises a prototype AWIN system. AHAS provides capabilities to combine information from various sources, from both on-board sensors and WINCOMM datalinks, and to display graphical weather information to the pilot. AHAS can automatically parse text and weather data, convert it to graphics, evaluate both tactical and strategic hazards in the weather data stream and provide alerts to pilots. The hazards assessed include crosswinds, ceiling, and visibility at the destination airport as well as proximity of SIGMETs enroute, winds aloft enroute, projected thunderstorm intercept, remarks from METARS stations along the flight plan, and PIREPs within a corridor of the flight plan. AHAS currently supports WxAP AWIN research but could in the future be adapted to integrate with TPAWS, synthetic vision, and capacity systems.

1.3 The components of the AHAS are derived from technologies developed under Cooperative Research Agreements (CRAs) between NASA and Rockwell Science Center (now Rockwell Scientific):

1.3.1 EWxR – Initiated as a CRA in October 1998, the Enhanced Weather Radar (EWxR) effort has demonstrated storm identification, tracking, and analysis techniques. EWxR provides the tactical weather analysis mode of AHAS. EWxR combines NEXRAD data with on-board weather data in a unique track-up display format. EWxR has extrapolation logic to project storm and aircraft's location into the future and predict an intersection. EWxR also correlates weather radar storms with NEXRAD attribute data, such as storm top information.

1.3.2 AWARE – Initiated as a CRA between NASA and Rockwell Science Center in October 1998, Aviation Weather Analysis and Reporting Enhancements (AWARE) is developing a flight path evaluation tool that automatically identifies and depicts weather hazards along a planned flight route. AWARE technology provides the strategic weather analysis mode of AHAS. It assesses the level of hazard in the context of the flight plan, aircraft capabilities, and pilot preferences for both VFR and IFR flight, providing information on hazards along the route, with the ability to quickly access the source of weather data.

1.3.3 Ground Station – A ground station (an expansion of the FY00 EWxR ground station and the weather data acquisition system of AWARE) has been developed by Rockwell. It receives weather products from weather vendors, processes them for uplink, and relays them to the aircraft via a WINCOMM datalink. The aircraft selectively accesses weather products from the ground station based on its flight plan.

1.3.4 AHAS – An implementation of the AWARE and EWxR technologies using commercial off-the-shelf (COTS) hardware had been developed and will be flight tested on the NASA B-757 ARIES

1.4 The EWxR system was flight-tested in December 2000 on the NASA B-757/ARIES aircraft. AHAS is currently being installed on ARIES for flight tests scheduled to run March through June, 2002. Another set of flight tests and demonstrations of WxAP systems is expected to occur in the second quarter of FY-03. AHAS technologies may also be adapted to support use in WxAP simulation experiments and additional flight experiments for both transport and general aviation aircraft.

2.0 TASK DESCRIPTION

2.1 Support for flight tests during the period March 12, 2002 through May 21, 2002. The contractor shall participate directly in ARIES WxAP Integrated Flight Experiments, train NASA personnel to operated AHAS equipment, and assist NASA in developing and analyzing questionnaires for evaluators of the system. At least 10 and as many as 20 research flights are anticipated over the available time period, of which the contractor shall participate on at least 8 flights to operate AHAS and evaluate its performance as an situational awareness tool for pilots. One to four "Remain OverNight" (RON) deployments to increase flight opportunities in convective weather (of duration one to four days) are expected. Go/no-go decisions will be made 24 hours before a potential flight and back-to-back flights may be conducted on up to 3 consecutive days to take advantage of weather conditions.

2.2 Design for a next-generation AWIN system to support WxAP transport and general aviation simulation and flight experiments through FY-05. The AWIN system design shall comprise an extensible and scalable weather information server to be located at NASA Langley Research Center, an airborne/laboratory weather database server architecture capable of implementation on both transport and general aviation research aircraft, hazard analysis system incorporating hazard analysis algorithms and capabilities for incorporating new experimental and operational weather products, accommodating NASA-supplied algorithms, and for adapting to various display and user interface hardware. The system shall be designed such that NASA or its on-site contractors can assume primary maintenance and programming responsibility. The design shall include a modular approach to both hardware and software, shall define an application programming interface (API) that will allow NASA researchers to create new code that can interface with and utilize AHAS proprietary software components, and shall include approximate hardware and software cost estimates. Note that this task is solely design and does not include any implementation, but does not preclude rapid prototyping where that may be an efficient design approach.

2.3 Examples of desired functionality include a researcher interface to select weather products, display characteristics; ability to program new displays and user interfaces; and capability to capture and time-stamp actions by subjects using displays and products. The system shall include both ground-based weather server and airborne (or simulator) processing and display components, and shall be capable of expansion to support integration and fusion of information from additional airborne sensor technologies such as Lidar, infrared (IR) imaging, Tropospheric Airborne Meteorological Data Reporting (TAMDAR), and lightning detection. The capability for interfacing to Microsoft Flight Simulator would be highly desirable for support of general aviation research applications.

2.4 Specific capabilities to be maintained or enhanced:

2.4.1 Interfaces to WINCOMM datalinks, standard airborne weather radar via ARINC-453 bus, and ARIES data busses including ARINC-429 and Ethernet for FMS flight plan information, navigation information, and TPAWS *in situ* products.

2.4.2 Weather data collection and archival for flight tests and simulation experiments.

2.5 Specific new capabilities to be incorporated:

2.5.1 Capability for adding additional graphical or gridded aviation weather products such as Integrated Turbulence Forecast Algorithm (ITFA), National Convective Weather Forecast (NCWF), Terminal Convective Weather Forecast (TCWF), weather information, visible and IR satellite images, lightning, and volcanic ash data.

2.5.2 Support use of conventional text mode, 2-d, 3-d, and 4-d weather product database and hazard analysis algorithms for NASA research purposes including generation and testing of new display formats, user interface concepts, and advanced algorithms for route optimization and decision aiding. The system shall be able to accommodate standard commercial, FAA, or NWS weather product formats such as FM 92-IX Ext. - gridded binary (GRIB), and FM 94-IX Binary Universal Form for the Representation of Meteorological data (BUFR). A new FAA format for aviation weather gridded data is being developed by NCAR (the National Center for Atmospheric Research) with funding from FAA FISDL (Flight Information Services Data Link) and should be supported if sufficient detail is available during the execution of the task. The system shall be capable of accommodating either request/reply or broadcast distribution of weather products, though not necessarily simultaneously.

2.5.3 Support generation and display of new tactical weather products based on TPAWS, NCAR, and TAMDAR in situ products, TPAWS experimental radar and in situ turbulence cockpit displays.

2.5.4 Adapt to AWIN-specified avionics display for ARIES cockpit for FY-03 flight experiments and demonstrations. The system shall be capable of accommodating both NASA and Rockwell-proprietary display products. The same display may also be utilized for display of other commercial or CRA-developed weather products, cockpit automation applications, Synthetic Vision applications, or for NASA capacity programs.

2.6 All software and documentation shall be provided in electronic formats acceptable to the NASA technical monitor. Reproducible softcopies or hardcopies of presentation materials shall be provided prior to all presentations. The two written final reports specified below shall be suitable for publication by NASA as contractor reports. Any proprietary supporting material (to be used only internally by NASA researchers) shall be clearly identified, delivered, and packaged separately.

3.0 DELIVERABLES

3.1 Kickoff and requirements refinement meeting on next-generation AWIN system; due two weeks after task initiation.

3.2 Next-generation AWIN system Midterm/Requirements review; due eight weeks after task initiation.

3.3 Next-generation AWIN system Preliminary Design Review; due sixteen weeks after task initiation.

3.4 Approval copy of a NASA Contractor Report on the Next-generation AWIN System, suitable for submission as a NASA publication, describing next-generation AWIN system design; due eighteen weeks after task initiation.

3.5 Final oral flight-test report with presentation materials; due twenty weeks after task initiation.

3.6 Approval copy of a NASA Contractor Report, suitable for submission as a NASA publication, describing FY-02 AHAS system, results of flight tests, evaluation of displays and weather information, and analysis of data; due twenty-two weeks after task initiation.

3.7 The contractor shall deliver brief monthly progress reports including the accomplishments for the preceding month, plans for the next month, an estimate for costs for the preceding month, and the identification of problems associated with the task (either technical or administrative). The reports shall be delivered by email in plain text or Microsoft Word format within 7 working days of the beginning of the following month.

4.0 PERFORMANCE

4.1 PERIOD OF PERFORMANCE

Thirty-two weeks after task initiation.

4.2 LOCATION

At contractor's site, at NASA Langley Research Center, and at flight test deployment sites TBD. (Sites currently under consideration include Kansas City, New Orleans, and other locations near the gulf coast).

5.0 SPECIAL REQUIREMENTS

5.1 SECURITY CLEARANCE

None

5.2 GOVERNMENT FURNISHED ITEMS

Access to AHAS systems as implemented for ARIES FY-02 WxAP Integrated Flight Experiments.

5.3 TRAVEL

Support at least 8 test flights, approximately half potentially at remote locations near the gulf coast, and 5 meetings or reviews at NASA Langley Research Center.